

## Remarks

### **Claim Amendments**

Claim 10 has been amended to specify the length of the cantilever. Support for this amendment can be found, among others, in claim 11 as previously presented. Claim 10 has also been amended to provide clear antecedent basis for the phrase "said/the back side" in claims dependent thereon. Process claim 21 has been amended accordingly. Claim 23 has been amended to more clearly describe the recess shape of the portion of the support described. Support for the amendment to claim 23 can be found in Figures 2 and 4 and their description. In particular, the depicted support portion 120. Claim 26 has been amended to more clearly define the special configuration of the cantilever assembly. Support can be found, among others in Figures 1 and 3.

### **Claim Objections**

On page 2, the Office objected to the disclosure because of various informalities.

In response, applicants made the suggested amendments.

On page 3, the Office objected to claims 10-22 because of various informalities and antecedent basis issues.

In response, applicants amended the claims as suggested by the Office and addressed all antecedent basis issues.

### **Indefiniteness Rejections**

On page 4, the Office rejected claims 18, 21, 22, and 24 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regard as the invention.

With regard to claims 18 and 24, the Office expressed the opinion that it not clear what is meant by "partly octagonal" because this term doesn't clearly define how many side "partly-octagonal" is supposed to represent. The Office noted that in Figure 2 of applicants' specification, the support appears to be an irregular hexagon.

In response, applicants have amended the claims accordingly.

With regard to claim 21, the Office expressed the opinion that it not clear what type of claim is being presented. The preamble recites a "process for manufacturing a cantilever assembly for scanning a sample"; however, claim lines 2-13 (i.e. the body of the claim) reads as an apparatus claim similar to apparatus claim 10. Then, claim lines 13-16 present process limitations. Thus, it is said to be not clear if applicants are claiming a method or an apparatus (Ex parte Lyell, 17 USPQ2d 1548).

In response, applicants have restructured the claim to render it a clear method claim. In the process the phrase "applying from a source of a high reflectance material the area of the high reflectance material and the sloping boundary" in claim 21 which the Office considered unclear has been amended. Applicants have clarified by this amendment that the sloping boundary is directed towards the support. Support for this amendment can be found, e.g., in Figure 1 and in claim 10.

### **35 USC 102(b) Rejections**

On page 5, the Office rejected claims 23 and 24 under 35 U.S.C. 102(b) as being anticipated by US 5,753,912 to Matsuyama (hereinafter "Matsuyama"). With respect to claims 23 and 24, Matsuyama is said to disclose a cantilever chip comprising a support section for supporting a cantilever. The support section is said to have a recessed portion narrowing in the direction towards the cantilever. Additionally, in an alternative embodiment, Figure 3D, the recessed portion of the support body is said to

be shaped as an irregular hexagon. The Office considered this to represent applicants' claimed partly-octagonal shape, given that applicants' disclosed shape is also an irregular hexagon.

Claim 23 and 24 have been amended to more clearly define the shape of the cantilever support. In particular, claim 23 has been amended to recite a cantilever support portion having a stepwise recessed flank profile which is further defined in claim 24 as having the shape of an irregular hexagon.

Applicants note that Matsuyama discloses in col. 3, lines 56 to 60 and claim 5 the shape of his cantilever chip (2) as having inclined faces (10, 12, 14, 16) preferably according to specific crystallographic planes (110).

However, Matsuyama does not disclose all limitations of claims 23 and 24 as amended, especially, the stepwise recessed flank portion as claimed, and thus does not anticipate these claims.

On page 6, the Office rejected claims 10, 17, 21, 23, and 25 under 35 U.S.C. 102(b) as being anticipated by US 5,245,863 to Kajimura et al. (hereinafter "Kajimura").

With regard to the limitations of independent claims 10 and 21, Kajimura is said to disclose an atomic force microscope and method of manufacturing one, comprising: a cantilever assembly for scanning a sample, comprised of: a cantilever having a cantilever tip, the cantilever being mounted to a rigid support and being provided with an area of high reflectance material on the back side of the cantilever. The Office expressed the opinion that the area appears to have a boundary sloping towards the support which fulfills the condition the area of the high reflectance material divided by the area of the sloping boundary area is greater than one. The area of high reflectance is said to be created by a source containing material having a high reflectance.

Claims 10 has been amended to specify that the cantilever is 1  $\mu\text{m}$  to 100  $\mu\text{m}$  long. Kajimura discloses cantilevers having a length of 500 $\mu\text{m}$  to 1000  $\mu\text{m}$  (see col. 4, line 46) rendering this 102 rejection moot for claim 10 and claim 17, which is dependent thereon. The limitation added has been previously recited in claim 11 and the combination of Kajimura with Viani et al., is discussed below under "35 USC §103(a) Rejections."

With regard to claim 23, applicants note that the recessed shape of Kajimura refers to a back upper surface of the support (17) opposite the face where the cantilever tip (14) is provided at the cantilever free end, whereas amended claim 23 refers to a recess of the cantilever support that has a stepwise recessed flank (i.e. side face) profile.

Thus, Kajimura does not disclose all elements of claims 23 (and 25, which is dependent on claim 23) as amended and thus does not anticipate these claims.

Also on page 6, the Office rejected claim 26 under 35 U.S.C. 102(b) as being anticipated by US 6,365,895 (Yamamoto). Yamamoto is said to disclose an apparatus for measuring a micro surface configuration utilizing a cantilevered probe. The probe is said to be formed of a single material and comprises a pointed tip section, a beam portion, and a proximal portion that is mounted to a support table. The Office expressed the opinion that the proximal portion of the cantilevered probe has a thickness that is substantially greater than the thickness of the beam portion.

In response, applicants have rephrased the claim to more clearly state that the step-like portion is on an opposite side of where the support is (see also Figs. 1 and 3).

In contrast, in Yamamoto the transition from the proximal portion (1c) to the beam portion (1b) of the cantilever (1) is provided on the same side (i.e. same face of the cantilever) where the cantilever (1) is mounted with its proximal portion (1c) to the rigid support table (4).

Thus, Yamamoto does not disclose all elements of claim 26 as amended and thus does not anticipate the claim.

### **35 USC 103(a) Rejections**

On page 7, the Office rejected claims 11 to 13 and 19 under 35 U.S.C. 103(a) as being unpatentable over Kajimura in view of "Small Cantilevers for Force Spectroscopy of Single Molecules" by Viani et al.(hereinafter "Viani").

With respect to the limitations of claims 11 to 13, the Office acknowledged that Kajimura fails to disclose a cantilever or an area of high reflectance material of the size claimed.

As noted above, and in accordance with the remainder of the Office reasoning, Kajimura also does not disclose cantilevers having a length of 1 $\mu$ m to 100  $\mu$ m.

However, Viani is said to disclose a process whereby small rectangular cantilevers are fabricated from silicon nitride. The cantilevers fabricated are said to have a length of 9-50 micrometers and metallic reflector pads have been added to the cantilever ends to maximize reflectivity. Although Viani is said to fail to expressly disclose the size of the reflector pad, the Office expressed the opinion that with a cantilever having a length of nine micrometers, naturally, the reflector pad would have an area of reflectance less than ten micrometers. Finally, the Office concluded that providing a "small" cantilever would have been obvious to one of ordinary skill in the art because it is well known in the art that small cantilevers have higher resonant frequencies than larger cantilevers, while simultaneously providing the same spring constants.

Claim 10 as amended requires that the cantilever having:

"having a length of 1 $\mu$ m to 100  $\mu$ m . . .being mounted to a rigid support and being provided on its back side facing away from the sample with an

area of a high reflectance material" (*emphasis added*)

Compare amendments to claim 21.

Applicants note that Viani teaches providing the reflector pad on the front side facing towards the sample to be scanned, as can be seen from his Figure 1e (and taking into account that the silicon support structure is always provided at the back side of AFM cantilevers), and also Figures 2a and 2b which show that separate cantilever tips are provided on the cantilever front side only in embodiments not having the reflector pads.

Applicants note that Kajimura deals with conventional cantilevers, which are fairly large (having at least about 500µm). In those large sized cantilevers a reflective area can be provided on the back side of the cantilever without encountering serious problems which arise when decreasing the size of the cantilever. These difficulties are described in detail on page 2, last full paragraph and the paragraph bridging pages 2 and 3 of the present disclosure.

Thus, assuming the person skilled in the art would consider the teachings of Viani when seeking to fabricate smaller cantilevers, what applicants neither admit nor deny, the person skilled in art, would, after considering the two references and in particular the teaching of Viani, position the reflective area on the front side of the cantilever.

In addition, claim 10 requires the area of high reflectance material to fulfill the following conditions:

"having a boundary sloping towards said support, wherein extensions (c, Δc) of the area and the boundary towards said support fulfill the condition  $c/\Delta c \geq 1$

wherein

c denotes an extension of the area of the high reflectance material in a direction towards the support, and

Δc denotes an extension of the sloped boundary of the area of the high reflectance material in direction towards the support." (*emphasis added*)

Applicants note that Kajimura does not disclose the ratio of the flat extension of his reflective mirror 18 and whether the extension of an adjacent slope boundary of the mirror should fulfill any specific conditions, in particular to be not less than 1 as set forth in claim 10 and claim 21. Applicants note that the Office refers for a disclosure of this limitation (see Office Action, paragraph 8. on page 6) to Fig. 1 of Kajimura. Applicants note that these Figures are schematic in nature and not to scale. The person of skill in the art would realize this as the size of the tip 14 which is shown in Fig. 1 (and other Figures) of Kajimura is dramatically larger than in reality. Thus, when considering and combining Kajimura with another reference, such as Viani, the person of skill in the art would be left with no teachings or guidance as to the specific conditions for the ratio of the flat extension  $c$  of the reflective area and the extension  $\Delta c$  of a sloped boundary of this area.

On page 8, the Office rejected claims 14 and 20 under 35 U.S.C. 103(a) as being unpatentable over US 5,245,863 (Kajimura) in view of US 5,319,961 to Matsuyama et al. ("Matsuyama").

Both rejected claims are now dependent on amended claim 10, which now incorporates aspects of claim 11.

The non-obviousness of amended claim 10 has been discussed above. Applicants submit that these dependent claims 14 and 20 are patentable for the reasons stated above in context of amended claim 10.

On page 9, the Office rejected claim 15 under 35 U.S.C. 103(a) as being unpatentable over US 5,245,863 (Kajimura) in view of Viani et al. as applied to claim 11 above, and further in view of US 5,319,961 (Matsuyama).

Claim 15 is dependent indirectly dependent on claim 10, whose non-obviousness has been discussed above. Applicants submit that claim 15 is patentable for the reasons

stated above in context of amended claim 10.

Also on page 9, the Office rejected claims 18 and 24 under 35 U.S.C. 103(a) as being unpatentable over US 5,245,863 (Kajimura) in view of US 5,753,912 (Matsuyama '912).

The Office acknowledged that Kajimura fails to disclose that the recessed part of the support is partly-octagonal, but submits that Matsuyama '921 provides the missing disclosure-(irregular hexagon).

Claim 18 is indirectly dependent on claim 10, whose non-obviousness has been discussed above. Applicants submit that claim 18 is patentable for the reasons stated above in context of amended claim 10.

Claim 24 is indirectly dependent on claim 23, whose patentability has been discussed above. In particular, claim 23 has been amended to more clearly distinguish from Matsuyama and in particular Kajimura. In particular, applicants noted that Kajimura refers to a back upper surface of the support (17) opposite the face where the cantilever tip (14) is provided at the cantilever free end, whereas amended claim 23 refers to a recess of the cantilever support that has a stepwise recessed flank (i.e. side face) profile. Applicants submit that Matsuyama '921 does not cure the deficiencies in Kajimura and that thus claim 24 is patentable for the reasons stated above in context of amended claim 23.

On page 10, the Office rejects claim 19 under 35 U.S.C. 103(a) as being unpatentable over US 5,245,863 (Kajimura et al.) in view of US 6,365,895 (Yamamoto).

Claim 19 is indirectly dependent on claim 10, whose non-obviousness has been discussed above. Applicants submit that claim 19 is patentable for the reasons stated above in context of amended claim 10.



On page 11, the Office rejects claim 27 under 35 U.S.C. 103(a) as being unpatentable over US 6,365,895 (Yamamoto) in view of US 5,245,863 (Kajimura).

The Office acknowledges that Yamamoto fails to disclose that the cantilever comprises an area of high reflectance material, which area has a boundary sloping towards the support, but expressed the opinion that Kajimura provides the missing disclosure.

Claim 27 is indirectly dependent on claim 26, whose patentability has been discussed above. In particular, claim 26 has been amended to more clearly distinguish from Yamamoto. In particular and as discussed above, claim 26 has been further amended to clarify that the cantilever is formed on a face opposite a face where the cantilever is mounted to the rigid support, which is in direct contrast to the configuration of Yamamoto. Applicants respectfully submit that Kajimura does not cure these deficiencies and thus should be allowable as well.

Applicants have addressed all outstanding informalities in the specification and claims and have addressed the indefiniteness rejections. Applicants have also shown that independent claim 10, 21, 23 and 26 as amended are patentable over the art cited.

The Commissioner is authorized to charge any fee deficiencies and overpayments to deposit account number 50-3135.

Respectfully submitted,

/Joyce v. Natzmer/  
Joyce von Natzmer  
Reg. No. 48,120  
**Pequignot + Myers LLC**  
Customer No. 46002  
Telephone: (212) 213-0135

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